Successful Government Use of High Performance Computing

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Examples of High Performance Computing in the Federal Government (1)

- **DOE National Nuclear Security Agency: Advanced Scientific Computing Initiative (ASCI); comprehensive 3D+T physics models of nuclear weapons; supercomputers rank 2, 3, 4, 5, 15, 19, 28, 32 on Top500 list***

- **DOE Office of Science: Scientific Discovery through Advanced Computing; 51 projects totaling $57M in climate, chemistry, fluid dynamics, fusion, high energy physics, software infrastructure, numerical libraries, software technology, collaborative tools; supercomputers rank 12, 16, 46, 61 on Top 500**

***www.top500.org**

Examples of High Performance Computing in the Federal Government (2)

- **NSF: Distributed Terascale Facility; HPC facilities for academic computing in physical sciences, biological sciences, engineering at UCSD, UIUC, Pittsburgh, ANL, Caltech; soon to be linked by 40 Gb/s network; 11.6 Tflops total peak; supercomputers rank 6, 82 on Top500**

- **NSF: NCAR climate/weather program; supercomputers rank 10, 33 on Top500**

Examples of High Performance Computing in the Federal Government (3)

- **DoD: HPC Modernization Program; distributed supercomputers supporting Services and academic researchers; Supercomputers rank 11, 20, 29, 40, 54, 57, 59, 62 on Top500**

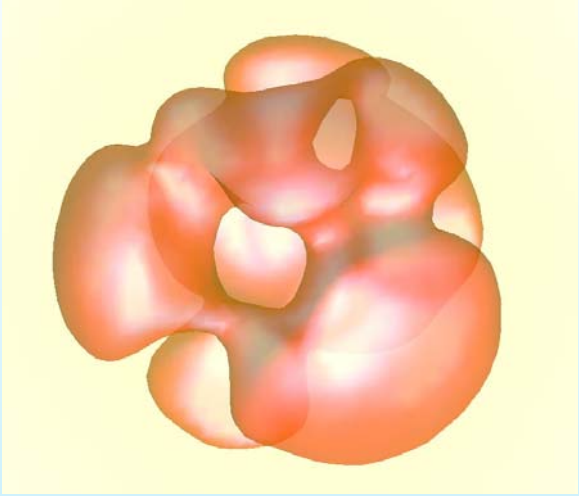
- **NOAA: Weather prediction, severe storms, climate modeling; supercomputers rank 8, 24, 25, 35, 36 on Top500**

Examples of High Performance Computing in the Federal Government (4)

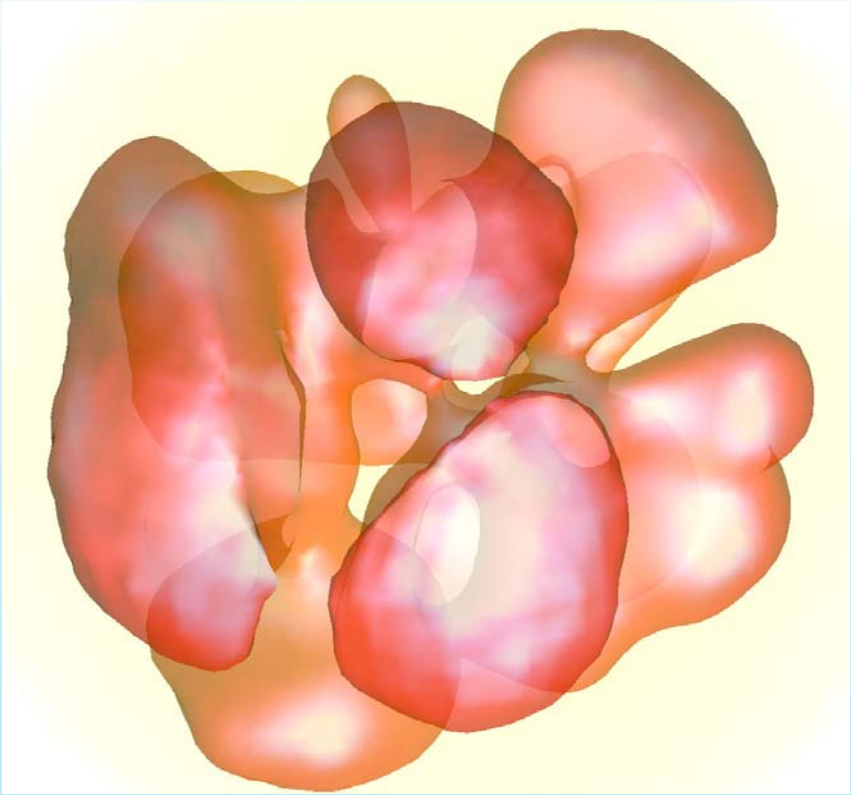
- NASA: Climate and space simulations; GSFC supercomputer ranks 18 on Top500
- NASA: Aerospace technology, climate simulations; ARC supercomputer ranks 60 on Top500

Explosion of a Super-Nova (not to scale) (DOE)

Start

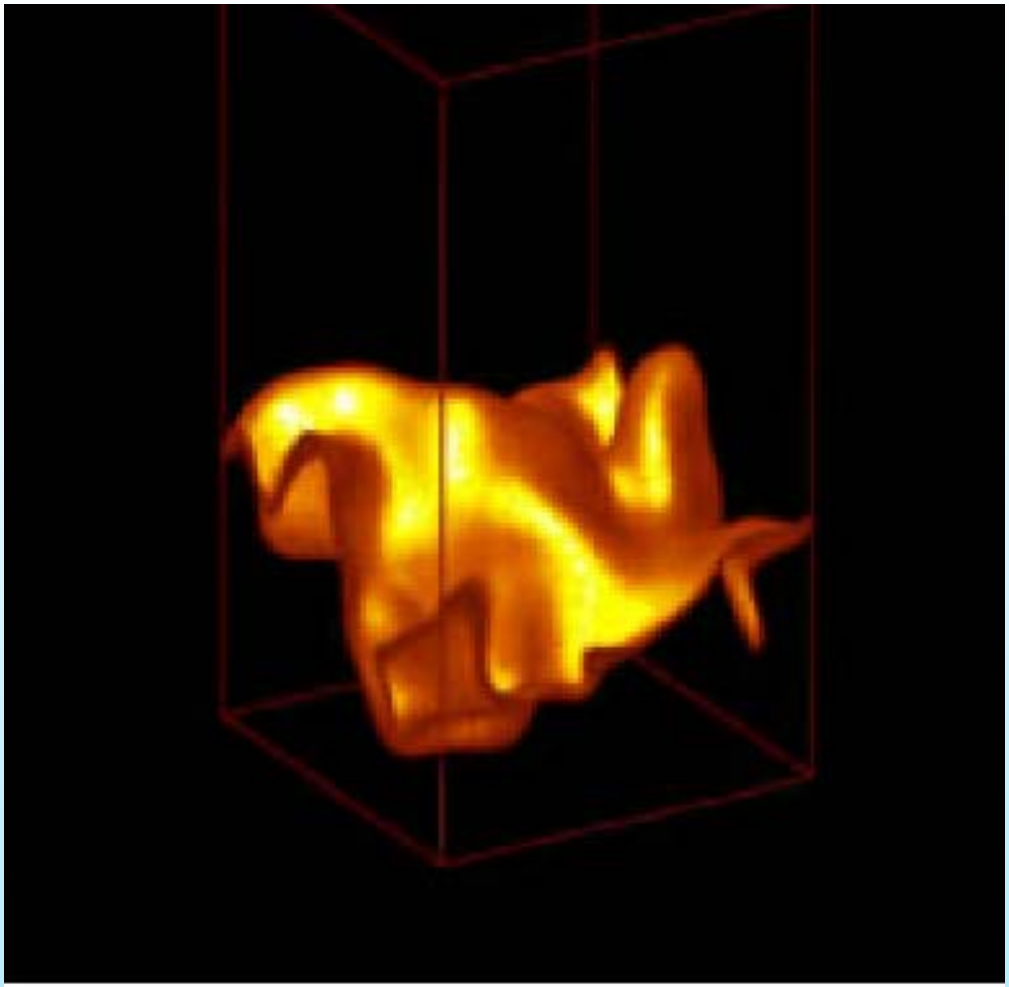


Middle



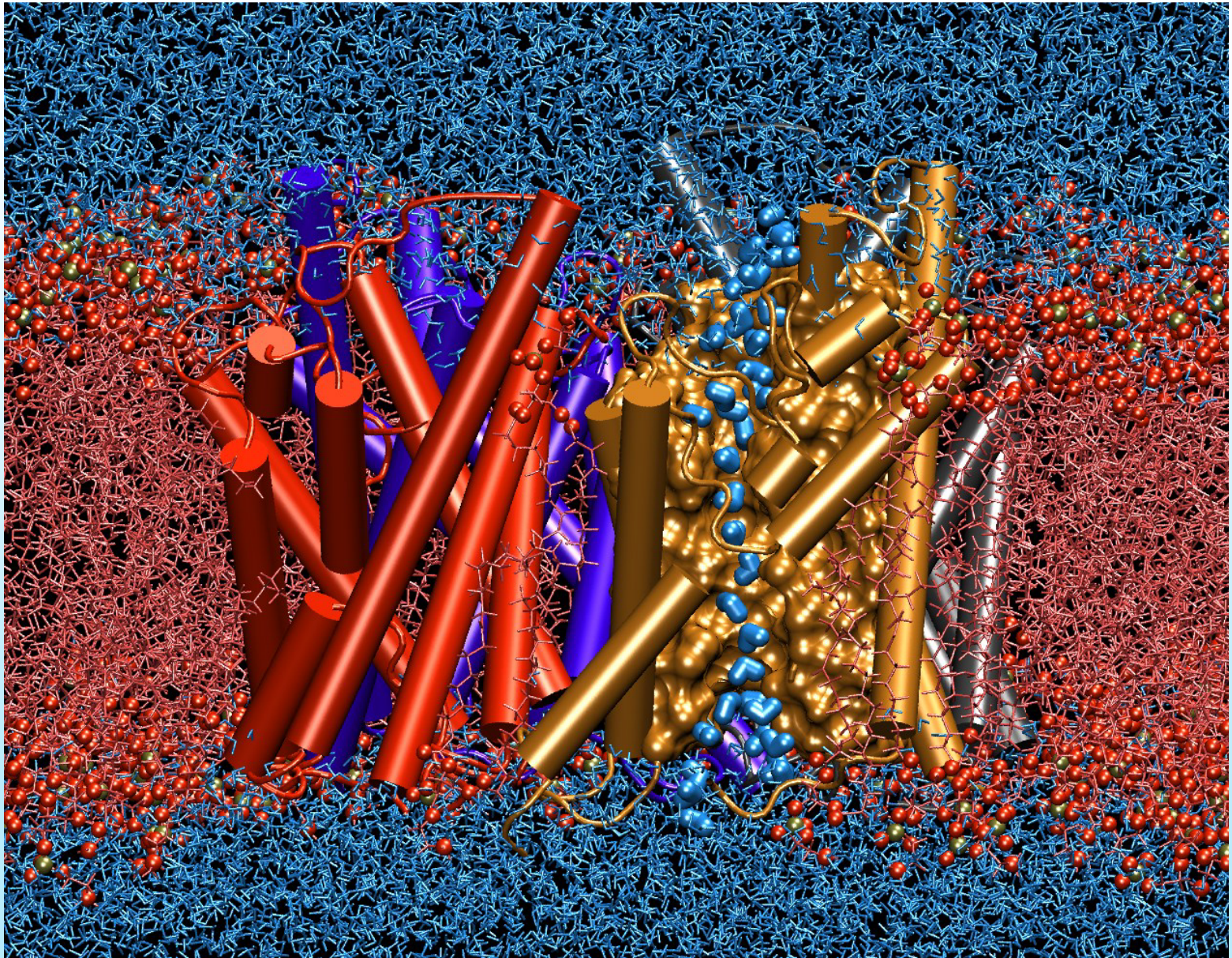
End

Simulation of Turbulent Flame with Comprehensive Chemistry (DOE)

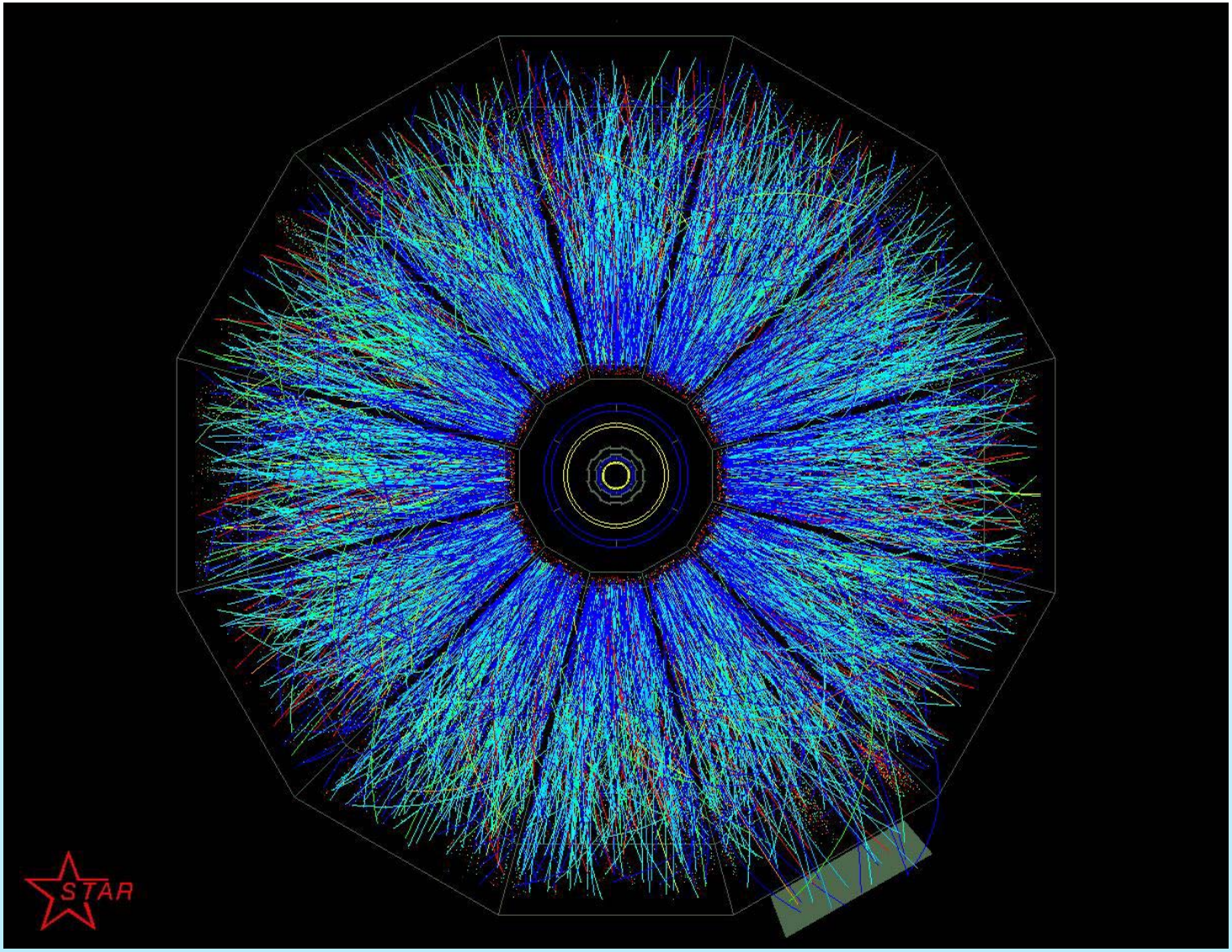


Flame surface from simulation of a turbulent premixed methane flame

Simulation of Aquaporin Protein Inside a Cell (NSF & NIH)



Collision of Deuterium Ion with Gold in Relativistic Heavy Ion Collider (DOE)



Grid Communications & Applications: High End Physics Problem

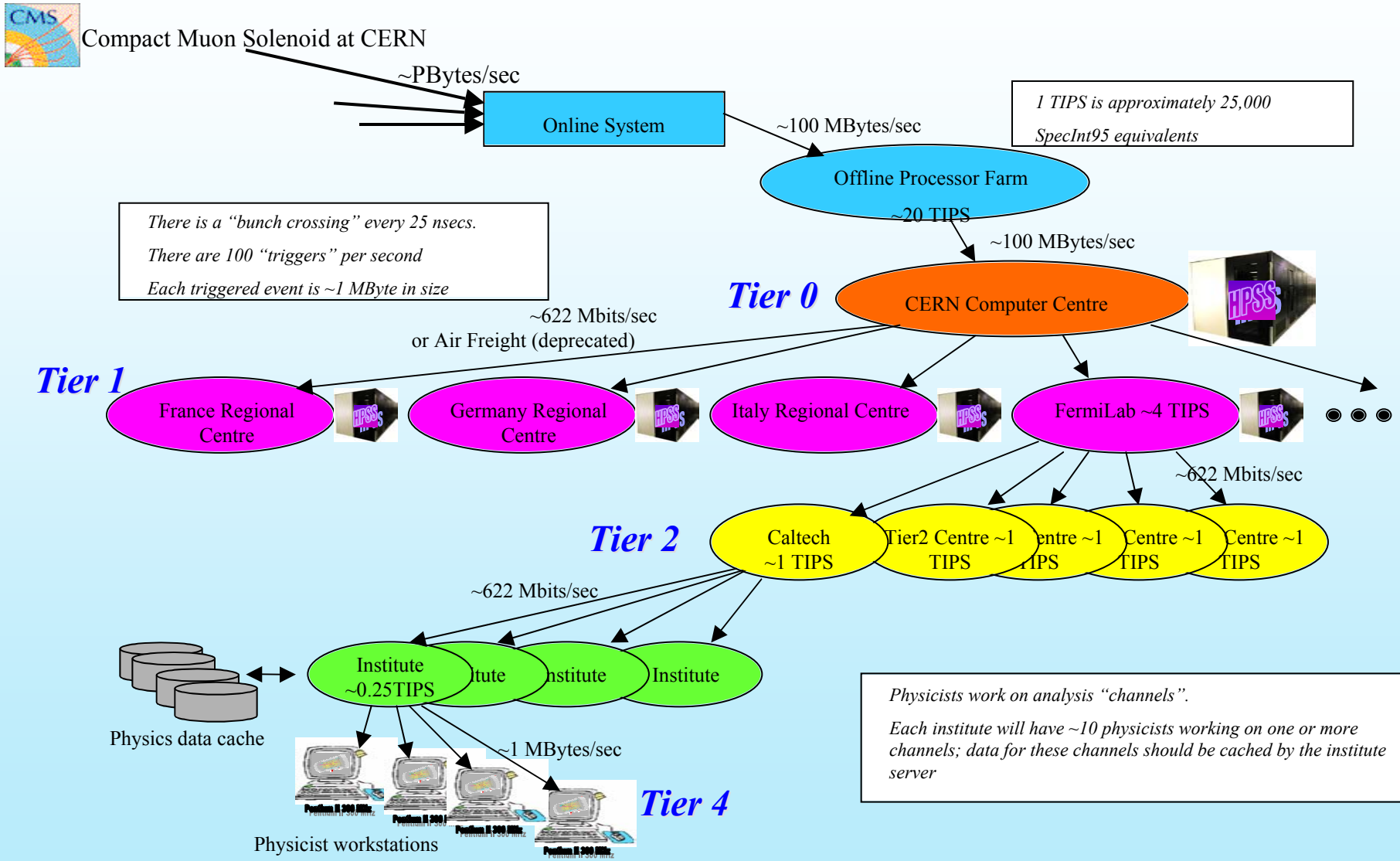


Image courtesy Harvey Newman, Caltech

Characteristics of Successful Modern High Performance Computing Programs

- Closely coupled to Agency Missions
- Managed as a strategic priority, with stable funding and support – typically not based on "pay by the pound"
- Strong leadership from above; strong science/engineering from below
- Projects involve experts in discipline science, computer science, mathematics
- Projects and programs are periodically peer reviewed for quality
- Successes are publicized to justify Agency and program funding

High End Computing Revitalization Task Force (HECRTF)

- **Charge: develop a 5-year plan to guide federal investments in HEC, based on the needs of important federal applications of HEC**
- **Tasks:**
  - Roadmap for core technology development
  - Road map for meeting resource needs of applications
  - Recommendations for improvements to the procurement process for HEC systems
- **Schedule**
  - May: rough draft
  - June: good draft
  - August: final report

For Further Information

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